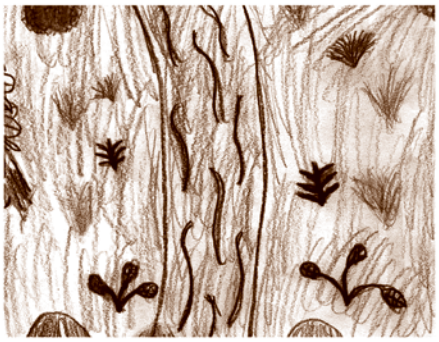


CARIE GARLETT

FIELD TRIP

Water Cycle

Theme
Water is essential for all life.

Utah State Core Curriculum Topic
Standard One: Students will understand that water changes state as it moves through the water cycle.

Objective One: Describe the relationship between heat energy, evaporation, and condensation of water on Earth.

Objective Two: Describe the water cycle.

Suggested Field Trip Location
The Nature Conservancy Scott M. Matheson Wetlands Preserve, Moab. Other locations are suitable for many of the activities. Any season except winter; students may get a little wet.

Times
All lessons are 30 minutes

Science Language Students Should Use
vapor, precipitation, evaporation, clouds, dew, condensation, temperature, water cycle

Background

Key words in the discussion of the water cycle are *evaporation, transpiration, condensation, precipitation, surface runoff (transportation)*, and *percolation*. Of these, *transpiration, condensation* and *percolation* are the words least familiar to fourth graders. *Transpiration* is the escape of moisture from plant leaves, similar to *perspiration* in humans and other animals. A helpful metaphor for explaining cloud *condensation* is a glass of ice water. Because air cools near the glass and cool air can't hold as much moisture as warm air, moisture condenses on the side of the glass. *Percolation* refers to the concept of water filtering down into the ground.

Most wetlands are transitional lands that lie between terrestrial systems (such as the Moab Valley) and aquatic systems (such as the Colorado River). The key ingredient in a wetland is water. Some wetlands always have standing water; others appear to be dry much of the year. All wetlands are at least seasonally flooded with shallow water, or the soils are at least seasonally saturated. All wetlands have specialized aquatic plants at least part of the year, specialized undrained soils, and the presence of water. The particular types and arrangements of these three characteristics are what make one kind of wetland distinct from another. *Marshes, swamps, potholes, bogs, fens, floodplain wetlands,* and *sloughs* are all names that reflect the diversity of wetlands. Some of these are informal names, including *slough*, the name historically used for the Matheson Wetlands.

Water comes into wetlands from two main sources: surface water and ground water. Surface water is runoff over the land. In the case of the Matheson Wetlands, Mill Creek, irrigation runoff, and the Colorado River are the main sources of surface water. Surface water follows gravity to the wetlands. That is, water from Mill Creek and its tributaries runs

downhill from the La Sal Mountains, across the Moab Valley, and then slows down in the relatively flat wetlands before continuing on the slight downhill grade to the Colorado River. The river contributes surface water to the wetlands only during springs when the river is high enough (near 40,000 cfs) to overflow its usual banks into the wetlands. The Colorado River flooded the Matheson Wetlands three out of every ten years prior to 1959; since then, the average has dropped to once every ten years (due to dams, irrigation, etc.). Much of the water in the Matheson Wetlands comes from ground water. Some springs and seeps where underground water comes to the surface emerge at the base of the slopes across highway 191 from the north end of the wetlands. Ground water also seeps to the surface within the wetlands themselves, from saturated underground rock layers and sediments near the surface.

Wetlands contribute to the quantity and quality of our water supply. Dry lands soak up some rain and briefly recharge or replenish ground water after a rainfall. Because wetlands collect runoff and store standing water over longer periods of time, they slowly release water to the ground-water supply. Wetlands and wetland plants are traps for both sediments and pollutants that are washed off the land. Because water traveling at high velocities has the ability to pick up and carry much sediment, water coming off of steep slopes is usually sediment-rich. When that water slows down, such as it does in the relatively flat lands found at the base of slopes where wetlands are commonly located, it drops its sediments. Plants contribute to slowing down the waters and act as sediment traps; they also filter nutrients from water and use them in their own metabolism. Wetlands keep pollutants (including excess nutrients), which are attached to sediment particles and in

School group at the Matheson Wetlands

PRET-TRIP ACTIVITY

Water on My Mind

the water, from degrading the quality of surface and ground water.

Objectives

Students will be able to:

a. Name the components of the water cycle.

b. Explain in their own words the processes of evaporation, condensation, and precipitation.

Materials

Aerial photo of Matheson Wetlands Preserve; *A Drop Around the World* (McKinney, 1998); Banana Slug String Band video (water cycle twist).

PROCEDURE

1) Show the students the aerial photo of the Matheson Wetlands, and orient them to it. Ask if it looks wet. Find out how many students have been to the wetlands. Let them know that the field trip stations will focus on different parts of the water cycle in the wetlands.

2) Explain to the students that you will be reviewing the water cycle by reading them a story. Tell the students that in the story, the water droplet travels not only around the water cycle, but also through out the world. For each page, select a volunteer to come up and point out the tiny water drop in the picture. As you read, discuss some of the concepts mentioned in the book.

3) Tell the students that you have a music video that is all about the water cycle. Direct them to stand up and sing and dance with the guys in the video. After the song, discuss some of the concepts talked about in the lyrics.

4) Review the items that students need to bring to school on the day of their field trip.

EXTENSION

Let students work on a water cycle themed crossword puzzle.

Beaver lodge at the Matheson Wetlands

STATION #1

Erosion Motion

Objectives

Students will be able to:

a. Compare rates at which water flows through different areas.
b. Name two benefits of water slowing down in the wetlands.

Materials

The Hero Twins and the Swallower of Clouds (Caduto & Bruchac, 1988, 78-81); 2 buckets; 20 beanbags; 4 name tags, each labeled *PLANT*; stopwatch.

PROCEDURE

1) Read the story *The Hero Twins and the Swallower of Clouds*. Briefly discuss why clouds, rain, and water are important to this region.

2) Have students look around and imagine what it would be like in a thunderstorm. Remind them that water always flows downhill, quickly on steep ground, and more slowly on less steep ground. Around Moab, it flows to the Colorado River and then downstream to the ocean. Point out the bare, steep slickrock, where the rain runs quickly downhill and is not stopped by anything. Next, point out or have them visualize washes, which are often less steep than the slickrock slopes. The less steep slopes slow the water, as do the plants at the edges of the wash. Finally, point out the wetlands, where there are so many plants and there is such a low slope, that the water almost stops. Tell the students that as water runs, it picks up soil and nutrients and carries them with it. Water carries the most sediments and nutrients when it is moving fast; as it slows down, the sediments and nutrients drop out of the water. Discuss the benefits of having water slow down in the wetlands. Slow-moving water a) keeps the wetlands soils from washing away, b) adds sediments to the area, c) adds nutrients, which combine with the sediments to form rich wetlands soils that nourish the plants, and d) collects in pools for wildlife to drink.

3) For the first round of the erosion activity, ask students to act out water from a rainstorm, which takes soil and nutrients from the top of the cliff to the river. Place two buckets 100 feet apart on the walkway, with the closest one full of beanbags. Have students line up at the beanbag bucket. As water, have each student carry soil and nutrients (a beanbag) down the slickrock slope (path) to the river (far bucket). Once they deposit their soil and nutrients in the river, have students run back to the beginning to get another load of nutrients. Instruct students to stay on the designated path. To avoid collisions, have those running to the river bucket stay on one side of the path and those returning to the beanbags stay on the other, as they will all be running simultaneously. Time how long it takes for the group to move all the soil/nutrients to the river.

4) In the second round, water runs down a wash instead of traveling across slickrock. Give one or two students plant nametags to wear, and place them along the edges of the path between the buckets to represent plants along the edge of the wash. Instruct the plant-students that they are rooted and cannot move their feet, but should try to capture nutrients from the water running by using their branches (arms). Any water-student that gets tagged must run around the plant twice (simulating soaking into the soil) and drop a nutrient bag at the plant's feet. Then, the tagged student can run back to the start and get another beanbag. Time how long it takes for the group to empty the soil/nutrient bucket. Compare the times of round one and round two, relating it to the slower movement of water down a plant-edged wash compared to movement down steep slickrock. Discuss how many sediments and nutrients the plants captured.

5) For the third and final round, water runs through a wetland. Designate two or three students as plants, and line them up in the middle of the path. Play and time as before. Discuss with the students how long it took the water to flow through the wetlands versus down washes or slickrock. Discuss how many sediments and nutrients the plants captured.

6) Review the results of the activity. Which places did water flow fastest and slowest? Where did it soak in the most and deposit the most sediments and nutrients? Why?

EXTENSION

Have students think of other areas in which rain falls. Ask them to write a story describing the movement of water through one of these areas.

STATION #2

Do the Water-Cycle Twist

(adapted from Caduto & Bruchac 1988, 90-91)

Objectives

Students will be able to:

a. Identify the four main parts of the water cycle.

b. Describe the processes of evaporation and condensation.

Materials

Water cycle poster; two full buckets of water and two empty buckets; two sturdy cups; lake and cloud signs; extra supply of water if not available in the wetlands.

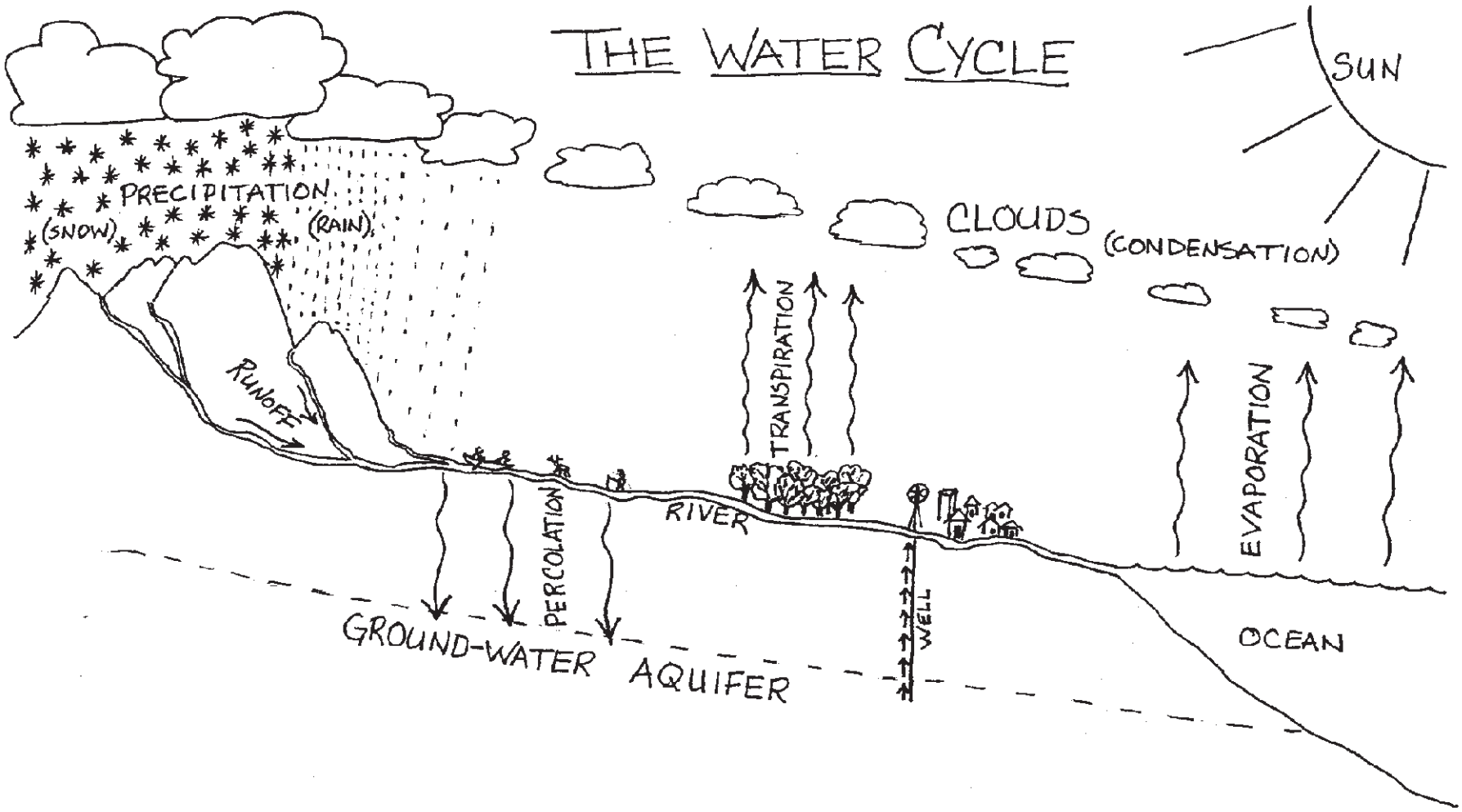
PROCEDURE

1) Using the water cycle poster, discuss and review the water cycle and its components (the six "tion" words, i.e. *evaporation, condensation, precipitation, transpiration*). Tell students to prepare to act out the water cycle in a relay. Place buckets in pairs, 35 to 40 feet apart, with the lake sign by the closer pair and the cloud sign by the other. Form two teams, and have them line up in two parallel lines behind the lake buckets. If you wish, have them name their teams for two wetland animals, and use that as a lead-in to talk briefly about a few of the wetland animals in the area.

2) Use guided imagery: "Imagine these (closer) buckets of water are big, blue lakes and you like to __in them." (Students fill in the blanks.) "As the sun heats up the lake, some water evaporates and rises up, cools off, and condenses to form white fluffy ____. Imagine that you are now evaporators with the power of the sun. When it is your turn, use the cup, scoop up water from the lake bucket, and run up to the clouds." Explain that it is important to conserve water; the object is to pour as much water into the cloud bucket as possible, while traveling as quickly as possible. After pouring, each student should run back and hand the cup to the next person in line. Start the relay. As students run, comment on what a hot day it must be with all this evaporation occurring, or describe the clouds getting heavier and darker. When both "lake" buckets are empty, walk to the other side and see which team evaporated the most water. The winning team is the one with the fuller end bucket (not always the team who emptied their bucket first). Commend students on the conservation strategies they came up with (hand over cup, cooperatively tipping bucket for easier scooping when water got low, etc.).

3) Have students stand with you in a circle, and tell them that they are going to work together to create a thunderstorm. They are to mimic whatever the person to the right is doing and make no other sounds. Start the storm off by rubbing your hands together (wait until everyone is doing this around the circle one by one), then click your fingers, then clap your hands on your knees, and finally stomp your feet. Reverse the order of the movements as the storm recedes. Ask the students if they recognized the sounds of a thunderstorm. Discuss runoff and percolation.

4) Have students line up in teams at the cloud buckets for another relay. Adjust the water volume in the buckets according to how much time you have left, and equalize them. Inform students that they are now precipitators and will take water from the cloud to the lake. Have them each choose a type of precipitation to be. Start relay, and interject comments as in the first relay.


THE WATER CYCLE
SUN
PRECIPITATION
(SNOW)
(RAIN)
CLOUDS
(CONDENSATION)
RUNOFF
TRANSPIRATION
EVAPORATION
RIVER
PERCOLATION
WELL
OCEAN
GROUND-WATER AQUIFER

STATION #3

Imagine!

Objectives

Students will be able to:

a. Describe the water cycle.

b. Identify changes in states of water that enable water to move through the water cycle.

Materials

Water cycle journey story (Project *WET* 1995, 159-160); water cycle puzzle cards; small poster describing lines of a diamante; quarter sheets of paper; pencils; clipboards

PROCEDURE

1) Review the water cycle. Distribute a water cycle puzzle card to each student. Ask them not to show the cards to each other. Tell the group that their goal is to make a circle in the correct order of the water cycle, without talking, by acting out what is on their cards. When they've reached the goal, have them all act out their parts in the cycle.

2) Tell the students that you are going to take them on an imaginary journey through the water cycle. Have them find comfortable spots, lie back, and look at the sky or close their eyes. Ask students to try to imagine what you are describing as you read *Water Cycle Journey*. Tell the students that they will be writing a unique kind of poem about some of their imaginings after listening to the story. Read the story.

3) Tell the students that they are going to write a poem called a diamante about the journey they just took or something they saw along the way. Hand out clipboards, paper, and pencils. Show the diamante poster as you describe each line, and leave it where students can refer to it.

Diamante

Line one: Write one word (noun) that is the favorite thing you saw as a raindrop.

Line two: Write two adjectives describing it.

Line three: Write three things it was doing (verbs or actions).

Line four: Write two feelings about it.

Line five: Write one word it reminds you of.

4) Encourage volunteers to read their poems.

EXTENSION

Have students create a puppet show, play, or story about a drop of water that travels through the entire water cycle. Have them include where the drop of water goes and conversations that it has with plants, animals, rocks, and other parts of the environment it meets along the way.

Writing diamantes at the Matheson Wetlands

STATION #4

Pollution Solution

(adapted from Slattery, 1991, 122; and Anderson et al, 1998, 9)

Objectives

Students will be able to:

a. Name three characteristics of wetland soil.
b. Describe two effects of wetland soil on water and pollution.

Materials

Trowel; observation tray; nine pie pans; nine milk jugs with tops cut off and holes in the bottoms; sand; gravel; wetland soil; water; cups; food coloring; clipboards; paper; pencils

Note

Before the activity, set up three sets of three milk jugs sitting in pie pans. One jug in each set will contain gravel, one sand, and the other wetlands soil. Also, put some wetland soil in an observation tray, and collect a jug of muddy water from the creek. Stir up the creek if necessary; the water must be *muddy* for this experiment to work persuasively.

PROCEDURE

1) Show students the tray of wetland soil. Ask students to explore the soil using all their senses. Note the dampness, color, scent, texture, smell, and different grain sizes. Ask students to compare the soil to soil they have seen in their backyards or in Arches National Park. Discuss the formation of soil in the wetlands and the plants (and thus animals) that benefit from this rich, organic soil.

2) Divide students into two or three groups. Each group will experiment with a set of three milk jugs/pie pans and will need a cup for pouring and a sheet of paper. Ask students to fold the paper lengthwise, for predictions on one side and results on the other. Have them divide the paper into thirds in the other direction, for the three substrates in the different milk jugs. Label the three: *gravel*, *sand*, and *wetland soil*. Ask the students to write down two predictions for each substrate: how fast the water will travel through the substrate and whether the water will be clear, slightly muddy, or very muddy when it exits. After they have written predictions for all three, they may begin pouring an equal amount of water through each, observing, and writing down the results for each on their sheet. When they are finished, discuss the results, including which soils acted as better filters and the beneficial effects of this filtering.

3) Ask students what might happen if the water we poured through the jugs was polluted. With their input, list a few pollutants that might be in the water entering the wetlands. Ask where they think the pollution would go if the wetlands were not here. If there's time, simulate the filtering of invisible pollutants by pouring colored water through a jug of wetlands soil. Discuss. Have students clean off their pie tins.

EXTENSION

In small groups, have students create soil that they think would both filter and hold water as well as wetlands soil does. Have each student in a group bring an element (i.e. dead plants, sand, and mud) to mix together. Compare a jug test on the mixture to the wetlands soil jug test. Discuss results and what they could add or take out to make the soil more like wetlands soil.

Learning about water pollution

POST-TRIP ACTIVITY

The Water Cycle Journey

Objectives

Students will be able to:

a. Reproduce a map-view drawing of their local area and label local features.

b. Integrate major components of the water cycle into their drawing.

Materials

Moab wetlands water cycle poster (or draw on board); unlined paper.

PROCEDURE

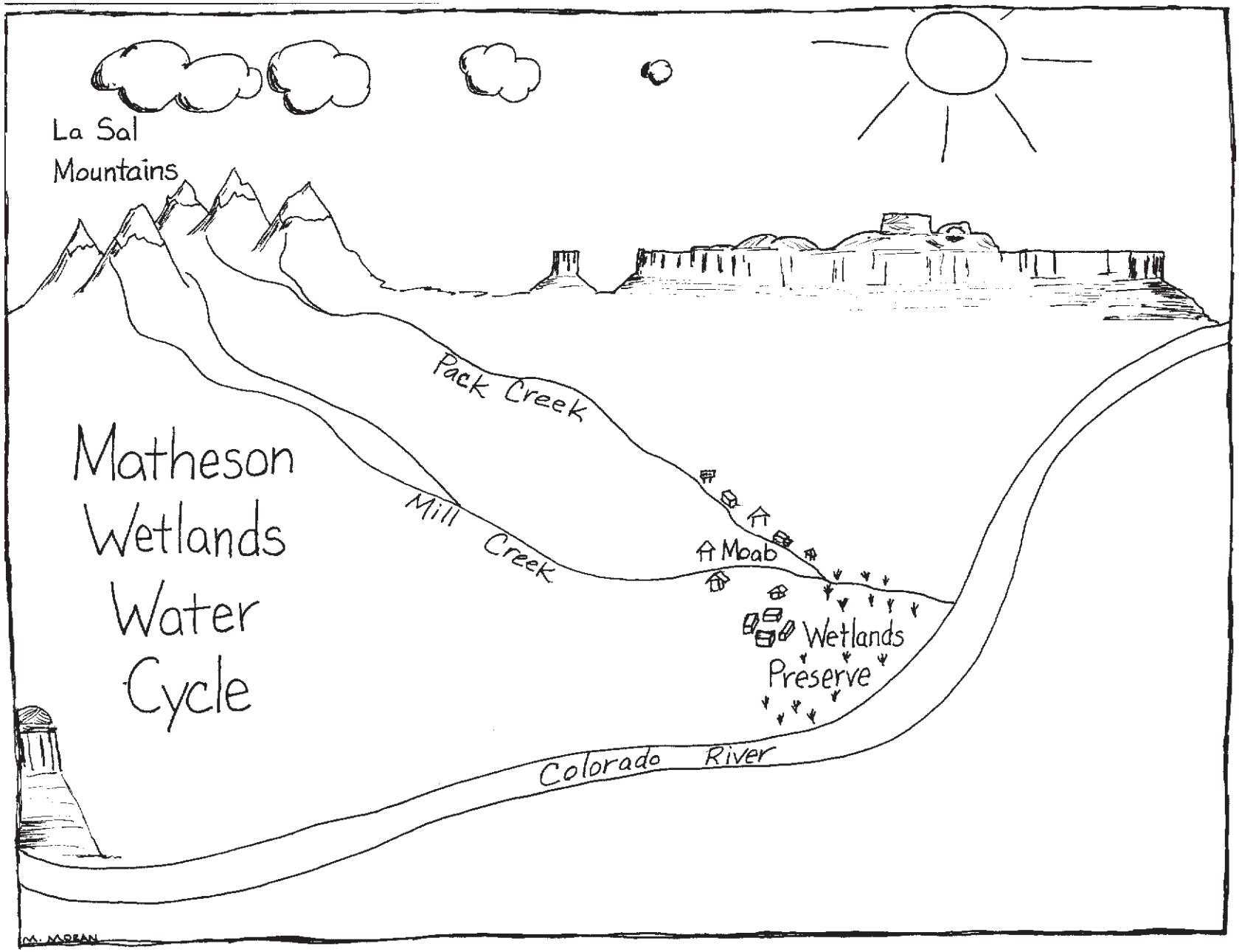
1) Review with students the four field trip stations. Write the water cycle components on the board as they are mentioned.

2) Show the poster, or draw its equivalent on the board, as you introduce it. Discuss the named features and their roles in the local water cycle. Instruct students to make a map (similar to the poster) on their own and to add the parts of the water cycle to it. On the blackboard, model how to integrate one of the water cycle components. The students should draw and label both the local physical features and the parts of the water cycle. Add to the blackboard list until it includes all features and components that they are to label.

3) Circulate among the students as they work on their drawings. Some of them might need help getting started or completing their drawing. If there is time, have a few volunteer students share their drawings with the class. Collect drawings, and give them to the classroom teacher.

EVALUATION

Have students create another water cycle drawing, this time of an imaginary land. Have them make up names for landforms and label the landforms, as well as, the water cycle components.



Matheson Wetlands Water Cycle

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